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## Use of Functional MRI to Evaluate Correlation Between Acupoints and Brain Cortex Activities: Comparison Between Conventional and Electrical Acupuncture

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**Abstract:** The use of acupuncture therapy in various functional disorders goes back several thousand years in China. Recently, acupuncture becomes a 'hot' topic in the functional Magnetic Resonance (MR) imaging research studies [1-4]. A majority of these research projects is to study the correlation between the acupuncture points (acupoints) and the corresponding brain cortices, either by conventional acupuncture, electro-acupuncture or laser acupuncture. Cho et al reported that by stimulating the vision-related acupoints (BL60, BL65, BL66, BL67) at the lateral side of the foot, neural response (i.e. high signal) was obtained at the visual cortex [1]. In this study, we verified Cho et al acupoints using conventional acupuncture and electro-acupuncture.

**Introduction:** A preliminary study to evaluate the correlation between acupuncture points (acupoints) and corresponding visual cortex using fMRI was carried out. Acupuncture was performed with two different techniques, namely, conventional acupuncture and electroacupuncture.

**Methods:** Functional MR imaging of the visual cortex in 13 healthy volunteers (5 male, 7 female, mean age 42) was performed using a 1.5 T clinical whole-body MR scanner (Signa Horizon Echospeed, version 5.51 software; General Electric Medical Systems, Milwaukee, Wisconsin, USA) with a 23 mT/m maximum gradient strength

gradient system. A quadrature head coil was used. After sagittal spin-echo [TR, 500 ms; TE, 8 ms] localiser images were acquired, functional MR imaging was performed using single-shot gradient-echo version of echo planar (GE-EPT) pulse sequence with the following scan parameters: TR, 3000 ms; TE, 60 ms; flip angle, 90°; matrix, 64 X 128; FOV, 24 cm X 24 cm; slice thickness, 6.0 mm; inter-slice gap, 1.0 mm; receiver bandwidth,  $\pm$  133 kHz; multi-phase and single excitation. The 30 second activation period was alternated by 30 second rest period. First, the functional MRI was performed with visual activation using light-emitting diodes (LED) flashing with a frequency of 8 Hz. The functional MRI was then repeated with conventional acupuncture and electroacupuncture at the following acupoints (BL60, BL 65, BL 66 and BL 67) located in the lateral aspect of the foot Fig. 1. Finally, T1-weighted spin-echo images of the same location were acquired.

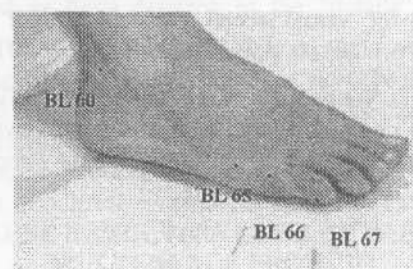


Fig. 1. Acupuncture Points

**Results:** The activated pixels in the primary visual cortex (V1) and secondary visual cortex (V2 and V3) created by visual activation correlate well with those created by both conventional acupuncture and electroacupuncture Fig. 2,3,4 and 5. There was no observable difference in the activated sites between conventional acupuncture and electroacupuncture. The results obtained by conventional acupuncture have relatively more neural responses due to other types of stimulation rather than visual activation. In contrast, the neural responses produced by electroacupuncture were mainly due to visual activation. The neural responses obtained by electroacupuncture at 2 Hz was found to be stronger than those obtained by electroacupuncture at 20 Hz. The neural response amplitude may be maximized by proper rate selection (7.8 Hz) or be undetectable due to selection of too high or too low a repetition rate [5].

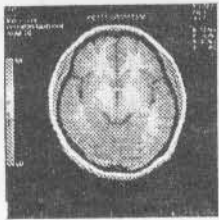


Fig. 2 LED Flashing 8Hz

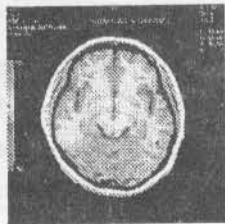


Fig. 3 Conventional Acup.

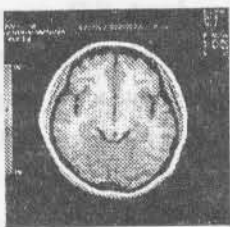


Fig. 4 Electroacup. 2Hz

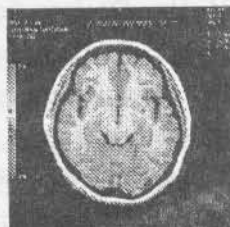


Fig. 5 Electroacup. 20Hz

**Discussion:** This result demonstrates that both the static and dynamic activation of the visual cortex by acupoint stimulation are consistent with LED flashing stimulation observed by fMRI. The greatest difficulty encountered by the researchers is that only 25 to 30% of the subjects undergoing acupuncture renders

expected neural response. According to oriental medicine, if subjects are able to get "deqi", the relative neural response can be obtained at relative cortex by fMRI. Based on our knowledge of Western medicine, this phenomenon is not well understood. Furthermore, the experimental results are not always reproducible from one group to another group.

**Conclusion:** Functional MRI can be used to evaluate correlation between acupoints and brain cortex activities.

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